PATENT ABSTRACTS OF JAPAN

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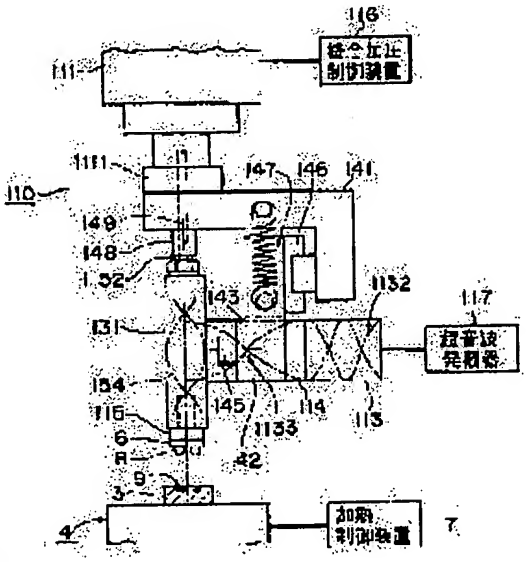
(54) FLIP-CHIP PACKAGING DEVICE AND PACKAGING METHOD OF FLIP CHIP

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a flip-chip packaging device which enables, the full bonding strength of an electronic component to a substrate is obtained and a stable bonding of the electronic component to the substrate, and the packaging method of a flip chip.

SOLUTION: A support member 131 formed into a tabular body is mounted to an ultrasonic wave horn 114 in a state that a holding member 115 inserted in the member 131 with a gap 132 in the member 131 is supported by the end part 1311 on one side of the end parts of the above support member 131 and the other end part 1312 of the above support member 131. Hereby, vibrations in the axial direction of the member 115 can be suppressed and moreover, as an applied pressure is made to act to the member 115 on the same axle, the full bonding strength of an electronic component to a substrate is obtained and a stable bonding of the electronic component to the substrate can be performed.



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CLAIMS

[Claim(s)]
[Claim 1] With the flip chip mounting equipment which gives pressurization and supersonic vibration to electronic parts (6), and joins the above-mentioned electronic parts to a junction substrate (3), ******, The vibrator which generates the above-mentioned supersonic vibration which vibrates along the rectangular direction which intersects perpendicularly in the thickness direction of the above-mentioned electronic parts and the above-mentioned junction substrate (113), The ultrasonic horn which attached the above-mentioned vibrator in the end section (1131) (114), The attachment component (115) which has the attaching part (1151) which extends along the above-mentioned thickness direction and holds the above-mentioned electronic parts at the end is supported near the above-mentioned attaching part. And flip chip mounting equipment characterized by having the supporter material (131) which prevents that it is fixed to the other end (1132) of the above-mentioned ultrasonic horn, and the vibration to the above-mentioned thickness direction arises in the above-mentioned attachment component by the above-mentioned supersonic vibration.
[Claim 2] The above-mentioned supporter material is flip chip mounting equipment according to claim 1 which the above-mentioned other end of the above-mentioned ultrasonic horn is located in between, and supports the above-mentioned attachment component in the above-mentioned thickness direction in two places (1311 1312) with the opposite part near [above-mentioned] the attaching part which countered near [attaching part] the above.
[Claim 3] The above-mentioned supporter material is flip chip mounting equipment according to claim 2 which becomes with the tube-like object in which the above-mentioned attachment component opens a clearance (132) in, and is inserted, and supports the above-mentioned attachment component only in the two above-mentioned places.
[Claim 4] Flip chip mounting equipment according to claim 1 to 3 further equipped with the pressurization member (148) which presses relatively the above-mentioned electronic parts and the above-mentioned junction substrate on the operation direction of the above-mentioned welding pressure, and the same axle with the welding pressure which acts in the above-mentioned thickness direction which contacted the above-mentioned supporter material or the above-mentioned attachment component, and was emitted from the pressurizer (111).
[Claim 5] The above-mentioned other end of the above-mentioned ultrasonic horn which fixes the above-mentioned supporter material is flip chip mounting equipment according to claim 1 to 4 equivalent to the knot section (1133) in the above-mentioned supersonic vibration emitted with the above-mentioned vibrator.
[Claim 6] Extend in the above-mentioned thickness direction, and on both sides of the above-mentioned supporter material, each counters in between and is arranged. And the above-mentioned supporter material is supported in the knot section (155) in bending vibration (154) produced in the above-mentioned supporter material in the above-mentioned supersonic vibration transmitted to the above-mentioned supporter material through the above-mentioned ultrasonic horn. And flip chip mounting equipment according to claim 3 further equipped with the 1st pressurization member (152-1) and the

2nd pressurization member (152-2) of the welding pressure which acts in the above-mentioned thickness direction emitted from the pressurizer (111), and the pair which presses relatively the above-mentioned electronic parts and the above-mentioned junction substrate in this direction.

[Claim 7] When acting ****** and the above-mentioned supersonic vibration on the above-mentioned electronic parts by the flip chip mounting approach which gives pressurization and supersonic vibration to electronic parts (6), and joins the above-mentioned electronic parts to a junction substrate (3), The flip chip mounting approach characterized by what is made for welding pressure to act on the attachment component (115) which holds the above-mentioned electronic parts and extends in the thickness direction of the above-mentioned electronic parts and the above-mentioned junction substrate, and the same axle when preventing and carrying out the above-mentioned pressurization of the above-mentioned electronic parts vibrating in the thickness direction of the above-mentioned electronic parts.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention gives pressurization and supersonic vibration to for example, IC chip, and relates to the flip chip mounting approach performed with the flip chip mounting equipment which joins the above-mentioned IC chip to a junction substrate directly, and this flip chip mounting equipment.
[0002]
[Description of the Prior Art] It is heated by drawing 9 , being controlled by the heating control unit 7 which conventional flip chip mounting equipment 30 was shown, the junction substrate 3 carried in by the transport device 2 was supplied to the heating stage 4, and was held and fixed to this heating stage 4, and was connected to the heating stage 4. Subsequently, sequential delivery of the IC chip 6 picked out from the wafer sheet 5 is carried out to the joint material 15 with which the junction pressurizer 1 is equipped. Adsorption immobilization is carried out at the joint material 15, and this IC chip 6 is positioned by recognition actuation in the predetermined location of the junction substrate 3. Subsequently, when the IC chip 6 can give pressurization and supersonic vibration to the junction substrate 3 with the junction pressurizer 1, metal junction of the bump 8 of the IC chip 6 and the electrode 9 of the junction substrate 3 is carried out.
[0003] As shown in drawing 10 and drawing 11 , the above-mentioned junction pressurizer 1 has the voice coil motor 11 as the mechanical component and pressurizer of the IC chip 6 and the junction substrate 3 which perform pressurization for junction while moving the above-mentioned joint material 15 in the thickness direction of the IC chip 6 or the junction substrate 3, a bracket 12 is formed in a part for the point of the driving shaft of this voice coil motor 11, and the ultrasonic horn 14 is attached in this bracket 12. The above-mentioned joint material 15 is attached in the end section of the ultrasonic horn 14, and vibrator 13 is attached in the other end. An ultrasonic wave oscillator 17 is connected to this vibrator 13, and vibrator 13 is made to generate supersonic vibration. Moreover, motion control of the above-mentioned voice coil motor 11 is carried out with the junction pressurization control unit 16.
[0004] In accordance with the shaft orientations, interruption is prepared in the above-mentioned ultrasonic horn 14, and as shown in drawing 11 , the joint material 15 is pinched by the shaft orientations of the joint material 15 by the above-mentioned interruption from the rectangular cross. In addition, as mentioned above, although the piping 24 for suction is connected to the joint material 15 in order that the joint material 15 may adsorb the IC chip 6, this piping 24 for suction is not supported by the bracket 12. Moreover, the location of the arbitration which hits the knot 22 of the longitudinal oscillation 21 of the supersonic vibration which the above-mentioned trembler 13 emits is broken by the bracket 12, bundle conclusion is carried out, and the ultrasonic horn 4 is pressurized by the voice coil motor 11 currently installed in the upper part of this bracket 22 as mentioned above.
[0005]
[Problem(s) to be Solved by the Invention] however, with the above conventional structures As shown in drawing 11 , the above-mentioned piping 24 for suction is not supported by the bracket 12. And since

the joint material 15 is broken by the ultrasonic horn 14 and pinched with the bundle, it is set at the junction process which the IC chip 6 can give pressurization and supersonic vibration to the junction substrate 3. The joint material 15 will use a conclusion part as the supporting point, and the disturbance vibration 25 rocked in the shape of a pendulum as a two-dot chain line shows will be generated like an elastic body. Since the disturbance vibration 25 of this joint material 15 is transmitted to the ultrasonic horn 14, the bending vibration 23 of the ultrasonic horn 14 cannot be certainly transmitted to the IC chip 6. In the above-mentioned bending vibration 23, it is vibration of the primary mode which is produced in the ultrasonic horn 14 by the supersonic vibration which vibrator 13 emits and to illustrate. When the above-mentioned disturbance vibration 25 does not act on the ultrasonic horn 14 but only the bending vibration 23 arises in the ultrasonic horn 14, the force will act on the IC chip 6 in the direction of slant so that the bending vibration 23 may illustrate to horizontal and a perpendicular direction. The following operations are performed because the force 23 to such a direction of slant, i.e., the above-mentioned bending vibration, arises. That is, removal of the oxide film of an electrode surface or dirt and promotion of the atomic diffusion between a bump and the above-mentioned electrode are made by vibration to the horizontal direction by the horizontal component in the force to the above-mentioned slanting direction, increase of welding pressure is achieved by vibration to the perpendicular direction by the perpendicular direction component in the force to the above-mentioned slanting direction, a bump is made to transform, a touch area with an electrode is expanded, and reservation of bonding strength is achieved. However, conventionally, with structure, since the disturbance vibration 25 is delivered that it mentioned above to the ultrasonic horn 14, the above-mentioned operation by the above-mentioned bending vibration 23 becomes difficult, and it has become the cause which sufficient bonding strength of the IC chip 6 and the junction substrate 3 is no longer obtained, and induces poor junction opening.

[0006] Furthermore, the ultrasonic horn 14 which is pinching the joint material 15 as mentioned above Since it is pinched by the bracket 12 and pressurization is made in a junction process in the moment direction which used the knot 22 as the supporting point through the bracket 12 to the joint material 15, It will become larger than the rigidity in the part into which the ultrasonic horn 14 pinches [the stress to generate] the joint material 15, the part into which a bracket 12 pinches the ultrasonic horn 14, and a bracket 12. Therefore, although it is extreme illustration, as shown in drawing 12 , according to the deformation in a bracket 12, the pinching part of the joint material 15, etc., it is with the joint material 15 and the heating stage 4, namely, maintenance of the parallelism of the IC chip 6 and the junction substrate 3 becomes difficult. Therefore, since not only the above-mentioned horizontal vibration but a vertical disturbance vibration will be compounded by the IC chip 6, it is the cause which sufficient bonding strength of the IC chip 6 and the junction substrate 3 is no longer obtained, and induces poor junction opening.

[0007] The miniaturization of an electron device is increasingly called for with small-and-light-izing of electronic equipment, mounting technology invites a turning point to a flip chip method from a wiring method, and it has been a big technical problem that a multi-pin IC chip is also joinable on a large scale in recent years further again. Under such conditions, it is clear that above-mentioned poor junction opening increases rapidly while it has been the conventional configuration, since increase of junction welding pressure and ultrasonic power is needed. [0008] It was made in order that this invention might solve such a trouble, and sufficient bonding strength of electronic parts and a substrate aims at offering the flip chip mounting equipment which is obtained and can perform stable junction, and an approach.

[0009]

[Means for Solving the Problem] This invention the 1st voice flip chip mounting equipment [like] With the flip chip mounting equipment which gives pressurization and supersonic vibration to electronic parts, and joins the above-mentioned electronic parts to a junction substrate, ******, The vibrator which generates the above-mentioned supersonic vibration which vibrates along the rectangular direction which intersects perpendicularly in the thickness direction of the above-mentioned electronic parts and the above-mentioned junction substrate, The attachment component which has the ultrasonic horn which attached the above-mentioned vibrator in the end section, and the attaching part which extends along the above-mentioned thickness direction and holds the above-mentioned electronic parts at the end is

supported near the above-mentioned attaching part. And it is characterized by having the supporter material which prevents that it is fixed to the other end of the above-mentioned ultrasonic horn, and the vibration to the above-mentioned thickness direction arises in the above-mentioned attachment component by the above-mentioned supersonic vibration.

[0010] This invention the 2nd voice moreover, the flip chip mounting approach [like] When acting ****** and the above-mentioned supersonic vibration on the above-mentioned electronic parts by the flip chip mounting approach which gives pressurization and supersonic vibration to electronic parts, and joins the above-mentioned electronic parts to a junction substrate, When preventing and carrying out the above-mentioned pressurization of the above-mentioned electronic parts vibrating in the thickness direction of the above-mentioned electronic parts, it is characterized by what is made for welding pressure to act on the attachment component which holds the above-mentioned electronic parts and extends in the thickness direction of the above-mentioned electronic parts and the above-mentioned junction substrate, and the same axle.

[0011]

[Embodiment of the Invention] The flip chip mounting approach performed with the flip chip mounting equipment in the operation gestalt of this invention and this flip chip mounting equipment is explained below, referring to drawing. In addition, in each drawing, the same sign is attached about the same component. Moreover, with this operation gestalt, the IC chip 6 mentioned above is taken for an example as an example equivalent to electronic parts. As shown in drawing 6 , the flip chip mounting equipment 101 of this operation gestalt has a configuration similar to the conventional flip chip mounting equipment 30 explained with reference to drawing 9 . That is, the place which is greatly different with conventional flip chip mounting equipment 30 and the flip chip mounting equipment 101 of this operation gestalt is a junction pressurizer, attaches a same sign about the component same among each component other than this as conventional flip chip mounting equipment 30, and omits explanation here. Moreover, the supersonic vibration used with this operation gestalt says extent in which junction to the IC chip 6 and the junction substrate 3 is possible, and a concrete target vibration with a frequency [of 64kHz], and an amplitude of about 0.5-2 micrometers. Moreover, although the IC chip 6 used with this operation gestalt is a silicon chip whose magnitude is **2mm as an example and the number of bumps is 20 pieces, magnitude can apply this operation gestalt even to the chip of 100 bump extent about **10mm, for example.

[0012] Although the junction pressurizer 110 with which the flip chip mounting equipment 101 of this operation gestalt is equipped is equipped with a voice coil motor 111, the junction pressurization control unit 116, an ultrasonic wave oscillator 117, etc., in illustration, the component 11 shown up, i.e., a voice coil motor, and the migration equipment part concerned for junction pressurizer 1 have taken the same configuration also in the above-mentioned junction pressurizer 110 with the conventional junction pressurizer 1 shown in drawing 10 rather than the bracket 12. That is, the voice coil motor 111 as an example which achieves the function of a pressurizer is equivalent to the above-mentioned voice coil motor 11, and the above-mentioned junction pressurization control unit 116 is equivalent to the above-mentioned junction pressurization control unit 16. Therefore, a part characteristic at the above-mentioned junction pressurizer 110 is a part which contains rather than a voice coil motor 111, downward part, i.e., bracket 112 grade, as shown in drawing 1 . therefore -- the following -- the above -- a characteristic part is explained.

[0013] The vibrator 113 which generates the supersonic vibration which vibrates also in the above-mentioned junction pressurizer 110 along the rectangular direction which intersects perpendicularly in the thickness direction of the IC chip 6 and the junction substrate 3, The ultrasonic horn 114 which attached this vibrator 113 in the end section 1131, It extended along the thickness direction of the IC chip 6 as an example of electronic parts, and while having the attachment component 115 equipped with the attaching part 1151 which holds the IC chip 6 at the end, in the junction pressurizer 110, the supporter material 131 as further shown in drawing 5 is formed. The supporter material 131 is a member it is made for the disturbance vibration 25 explained with reference to drawing 11 not to generate in the above-mentioned attachment component 115. With this operation gestalt, the supporter material 131

becomes with the tube-like object in which an attachment component 115 is inserted, having a clearance 132 in accordance with the shaft orientations of an attachment component 115, and supports an attachment component 115 in two places, the end section 1311 of the insertion part which an attachment component 115 penetrates, and the other end 1312. Such supporter material 131 is fixed to the other end 1132 of the ultrasonic horn 114. Moreover, it can also fabricate in one with the ultrasonic horn 114 like this operation gestalt.

[0014] Moreover, with this operation gestalt, in order to enable correspondence for the various IC chips 6 with which magnitude etc. differs, in two places which were mentioned above, the supporter material 131 considers as the structure which supports an attachment component 115, and makes the attachment component 115 removable structure to the supporter material 131. However, as shown in drawing 7 , the above-mentioned attaching part 1151 may be arranged near the other end 1132 of the ultrasonic horn 114, and the supporter material 1315 can also be constituted so that an attachment component 115 may be fixed in one place 1151, i.e., an attaching part, and supposing it does not change an attachment component 115, as shown in drawing 8 , an attachment component 115 may be fixed to the supporter material 1315 by welding in the both-ends part of the supporter material 1315.

[0015] The above-mentioned clearance 132 is a clearance between extent explained below. That is, in the supporter material 131, as a two-dot chain line shows to drawing 1 by the above-mentioned supersonic vibration emitted from vibrator 113, the above-mentioned bending vibration 23 and the bending vibration 154 of the same primary mode arise. Although vibration arises by the above-mentioned supersonic vibration emitted from vibrator 113 on the other hand also to the attachment component 115 currently supported by the supporter material 131, since an attachment component 115 is thin compared with the supporter material 131, it will not become the primary mode like the above-mentioned bending vibration 154, but will become vibration of two or more mode. therefore, the above-mentioned plurality in an attachment component 115 -- if vibration of degree the mode gets across to the supporter material 131, the supporter material 131 will be made to produce disturbance vibration So, with this operation gestalt, the clearance 132 between extent which prevents that the external surface of the attachment component 115 which is vibrating, and the inside of the supporter material 131 which becomes with a tube-like object contact was formed. thus, by preventing the above-mentioned contact, the above-mentioned disturbance vibration by the attachment component 115 is transmitted to the ultrasonic horn 114 -- not making -- the bending vibration 154 of the ultrasonic horn 114 -- an attachment component 115 -- minding -- IC chip -- it can transmit certainly 6 HE. Since the amplitude of the above-mentioned bending vibration in the ultrasonic horn 114 was about 2 micrometers, the above-mentioned clearance 132 was set to about 5 micrometers with this operation gestalt. However, the value of a clearance 132 should just be the dimension which is not limited to the above-mentioned value and can prevent that the inside of the supporter material 131 and the external surface of an attachment component 115 contact as mentioned above.

[0016] Since the clearance 132 which was mentioned above is produced, with this operation gestalt As shown in drawing 5 , the above-mentioned attaching part 1151 of an attachment component 115 is made into a configuration with a stage, carries out fitting to the end section 1311 of the supporter material 131, and is fixed. In the other end 1312 of the supporter material 131 For example, a nut 134 is made to screw in the screw section 135 formed in the attachment component 115 in the condition of having made the color 133 intervening, and an attachment component 115 is fixed to the supporter material 131. In addition, with this operation gestalt, as mentioned above, since an attachment component 115 holds the IC chip 6 in adsorption actuation, as shown in drawing 5 , the path 1153 for suction is formed in the attachment component 115, and the path 1153 for suction extends exceeding the screw section 1152. Moreover, since disturbance vibration which becomes the supporter material 131 in various waves is not produced, it is almost desirable [the supporter material 131] at an interstitial segment for it to be attached in the ultrasonic horn 114, or to be fabricated in one with the ultrasonic horn 114 like this operation gestalt in the extension direction of the supporter material 131, so that it may illustrate.

[0017] The supporter material 131 which has the above-mentioned structure where the ultrasonic horn 114 in which vibrator 113 was attached was attached is attached in the driving shaft edge 1111 of a

voice coil motor 111 with the attachment structure of having the 1st bracket 141 and the 2nd bracket 142, as shown in drawing 1 . That is, the L character-like 1st bracket 112 is attached in the driving shaft edge 1111. On the other hand, as shown in the ultrasonic horn 114 at drawing 2 , the lug 143 for attachment of the pair for attaching the 2nd bracket 142 along the direction which intersects perpendicularly in the extension direction of the ultrasonic horn 114 concerned protrudes on the predetermined location. This predetermined location is a location where the lug 143 for attachment contacts the 2nd bracket 142 in the location of the knot 1133 in vibration when the longitudinal oscillation 1132 emitted from the vibrator 113 attached in the end section 1131 of the ultrasonic horn 114 is transmitted to the ultrasonic horn 114. Thus, by the lug 143 for attachment and the 2nd bracket 142 contacting in a knot 1133, and being concluded as follows, since longitudinal oscillation is controlled (i.e., since it becomes impossible for the ultrasonic horn 114 to resonate), it can control change of the frequency characteristics of the ultrasonic horn 114 by bolting torque. In order that the 2nd bracket 142 of the above may avoid contacting the ultrasonic horn 114 directly, it is a concave configuration which has the notching 144 for ultrasonic horn 114, and is concluded with the above-mentioned lug 143 for attachment with the bolt 145 for immobilization. The supporter material 131 which has an attachment component 115, the ultrasonic horn 114, and a trembler 113 are fixed to the 2nd bracket 142 by this conclusion.

[0018] While such the 1st bracket 141 and the 2nd bracket 142 are mutually engaged through the linear guide 146, and the migration direction is guided in this linear guide 146, they are movable along the above-mentioned thickness direction to the 1st bracket 141. [of the 2nd bracket 142] Moreover, the medial axis of the supporter material 131, i.e., the medial axis of an attachment component 115, is located on the driving shaft which extends along the above-mentioned thickness direction of a voice coil motor 111 in the linear guide 146 where the 1st bracket 141 and the 2nd bracket 142 are engaged, and the same axle. Moreover, between the 1st bracket 141 and the 2nd bracket 142, the spring 147 which energizes the 2nd bracket 142 to the 1st bracket 141 side along the above-mentioned thickness direction is formed. The pressurization member 148 is formed in the 1st bracket 141 on the driving shaft of a voice coil motor 111, and the same axle further again. As mentioned above, since the 2nd bracket 142 which the attachment component 115 extended on the above-mentioned driving shaft and the same axle, and attached the supporter material 131 is energized by the above-mentioned spring 147 at the 1st bracket 141 side, the pressurization member 148 always contacts the above-mentioned screw section 1152 or the above-mentioned nut 134 of the attachment component 115 fixed to the supporter material 131 so that it may illustrate. Therefore, the pressurization member 148 pressurizes an attachment component 115 in the arrow-head 149 direction through the above-mentioned driving shaft edge 1111 and the 1st bracket 141 because the above-mentioned driving shaft of a voice coil motor 111 moves in the arrow-head of above-mentioned thickness direction 149 direction. In addition, the attachment component 115 which has the path 1153 for suction has penetrated the pressurization member 148, the 1st bracket 141, and the driving shaft edge 1111.

[0019] Next, although actuation of the flip chip mounting equipment of this operation gestalt which has the attachment structure which is shown in drawing 1 , and which was mentioned above is explained, since actuation other than the mounting actuation to the junction substrate 3 of the IC chip 6 is unchanging in the actuation in the former, explanation here is omitted. Therefore, below, the actuation when mounting the IC chip 6 in the junction substrate 3 is explained. A trembler 113 oscillates with an ultrasonic wave oscillator 117, and supersonic vibration of the IC chip 6 currently held at the attachment component 115 is carried out. Since it is supported by the supporter material 131 after the attachment component 115 has formed the clearance 132 as mentioned above with this operation gestalt at this time, and the ultrasonic horn 114 is being fixed to this supporter material 131, the supporter material 131 can prevent generating of disturbance vibration. therefore, the bending vibration 154 in the ultrasonic horn 114 131, i.e., supporter material, -- IC chip -- since it can transmit certainly 6 HE, junction quality can be raised. Furthermore, in such the condition, a voice coil motor 111 operates, pressurization is performed in the arrow-head 149 direction by the pressurization member 148, an attachment component 115 is pressed by the junction substrate 3 in the IC chip 6 on this pressurization direction and the same

axle by this pressurization, and this thrust is controlled by control of the junction pressurization control device 16.

[0020] Therefore, the precision of 2 micrometers or less as a value of parallelism demanded between the attaching parts 1151 of an attachment component 115 and the heating stages 4 in the unloaded condition which sufficient bonding strength of the IC chip 6 and the junction substrate 3 is obtained, and omits the above-mentioned press can be maintained at the time of pressurization, and it becomes joinable [stable]. In addition, the precision of the above-mentioned 2 micrometers or less is the case where the sizes of the IC chip 6 are **2mm and the welding pressure of 14.6Ns, and only the precision of about 10 micrometers was acquired in these conditions with conventional flip chip mounting equipment.

[0021] Moreover, the installation structure to the voice coil motor 111 of the supporter material 131 which formed the attachment component 115 is not limited to the structure shown in drawing 1 R> 1 and drawing 2 , and can also take the structure of the junction pressurizer 151 shown in drawing 3 and drawing 4 . That is, as shown in drawing 4 , each extends in the above-mentioned thickness direction, it has the 1st pressurization member 152-1 and the 2nd pressurization member 152-2 of a pair which are countered and arranged on both sides of the supporter material 131 in between, and a whole configuration attaches the KO character-like support pressurization member 153 in the above-mentioned driving shaft edge 1111 of a voice coil motor 111. The above-mentioned 1st pressurization member 152-1 and the 2nd pressurization member 152-2 support the supporter material 131 by the support pin 156 prepared in the location corresponding to the knot section 155 in the bending vibration 154 produced in the supporter material 131 in the above-mentioned supersonic vibration transmitted to the above-mentioned supporter material 131 through the above-mentioned ultrasonic horn 114. Thus, since pressurization becomes possible through the knot section 155 of the bending vibration 154 by supporting the supporter material 131 in the knot section 155, the bending vibration 154 stabilized more can be obtained. Therefore, since the this stable bending vibration 154 will act on the IC chip 6, junction to the junction substrate 3 of the IC chip 6 can be strengthened more.

[0022] Furthermore, the 1st pressurization member 152-1 and the 2nd pressurization member 152-2 are moved to the shaft orientations of the attachment component 115 with which the above-mentioned thickness direction 131, i.e., supporter material, is equipped in the supporter material 131 through the above-mentioned support pin 156 because the driving shaft of a voice coil motor 111 moves in the above-mentioned thickness direction. Therefore, the IC chip 6 currently held at the attaching part 1151 of an attachment component 115 can be pressed along the above-mentioned thickness direction to the junction substrate 3. Thus, also in the junction pressurizer 151, the precision of 2 micrometers or less as a value of parallelism demanded between the attaching parts 1151 of an attachment component 115 and the heating stages 4 in the unloaded condition which sufficient bonding strength of the IC chip 6 and the junction substrate 3 is obtained, and omits the above-mentioned press like the case of the above-mentioned junction pressurizer 110 can be maintained at the time of pressurization, and the stable junction is possible.

[0023] In addition, although each pressed the IC chip 6 to the junction substrate 3 with the voice coil motor 111, you may constitute from an operation gestalt mentioned above so that migration equipment may be formed in the heating stage 4 in which the junction substrate 3 was laid contrary to this and the junction substrate 3 may be pressed to the IC chip 6. What is necessary is just to take the configuration which is made to move the IC chip 6 and the junction substrate 3 relatively, and can aim at both press in short.

[0024] Moreover, with an above-mentioned operation gestalt, although the IC chip 6 was held in adsorption actuation, the configuration which is not limited to this, for example, holds the mechanical IC chip 6 can also be taken.

[0025]

[Effect of the Invention] The flip chip mounting equipment [like] and the attachment component which has the attaching part which is equipped with supporter material according to the flip chip mounting approach [like] the 2nd voice, and holds electronic parts about this supporter material of this invention are supported near the above-mentioned attaching part, and it was made to fix to the other end of the

above-mentioned ultrasonic horn the 1st voice, as explained in full detail above. Therefore, since the disturbance vibration to the thickness direction over the electronic parts held in an attachment component is inhibited and bending vibration which is an ultrasonic horn can be transmitted to the above-mentioned electronic-parts HE authenticity, sufficient bonding strength of electronic parts and a junction substrate is obtained, and junction quality can be raised.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the side elevation showing the supporter material part of the junction pressurizer in the flip chip mounting equipment of the operation gestalt of this invention.
[Drawing 2] It is the front view of the supporter material part shown in drawing 1 .
[Drawing 3] It is the side elevation showing the modification of the supporter material part shown in drawing 1 .
[Drawing 4] It is the front view of the supporter material part shown in drawing 3 .
[Drawing 5] It is the sectional view of supporter material shown in drawing 1 - drawing 4 .
[Drawing 6] It is the perspective view of the flip chip mounting equipment of the operation gestalt of this invention which has the supporter material shown in drawing 1 .
[Drawing 7] It is the side elevation showing still more nearly another modification of the supporter material part shown in drawing 1 .
[Drawing 8] It is the side elevation showing the modification of the supporter material part shown in drawing 7 .
[Drawing 9] It is the perspective view of conventional flip chip mounting equipment.
[Drawing 10] It is the perspective view of the junction pressurizer part with which the conventional flip chip mounting equipment shown in drawing 9 is equipped.
[Drawing 11] It is the side elevation showing the attachment component part in the conventional junction pressurizer shown in drawing 10 .
[Drawing 12] In the attachment component part shown in drawing 11 , it is drawing for explaining the case where the parallelism of IC chip and a junction substrate deteriorates.
[Description of Notations]
3 -- a junction substrate, a 6 --IC chip, 101 -- flip chip mounting equipment, and 111 -- a voice coil motor, 113 -- vibrator, a 114 -- supersonic-wave horn, and 115 -- an attachment component, 131 -- supporter material, a 148 -- pressurization member, and 152-1 -- the 1st pressurization member, the 152-2 -- 2nd pressurization member, 154 -- bending vibration, and 155 -- the knot section, the 1132 -- other end, 1133 -- knots sections and 1151 -- -- an attaching part, the 1311 -- end section, and the 1312 -- other end

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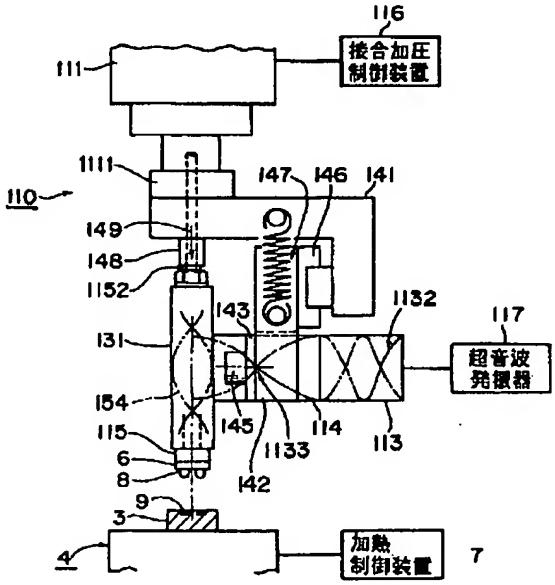
(54)【発明の名称】　フリップチップ実装装置、及び方法

(57)【要約】
【課題】　電子部品と基板との十分な接合強度が得られ、安定した接合を行える、フリップチップ実装装置、及び方法を提供する。
【解決手段】　筒状体にてなる支持部材１３１は、隙間１３２を有して挿通された保持部材１１５を、上記支持部材の一端部１３１１及び他端部１３１２にて支持して、超音波ホーン１１４に取り付けられる。よって、保持部材の軸方向への振動を抑えることができ、又、保持部材を同軸上にて加圧力を作用させることから、電子部品と基板との十分な接合強度が得られ、かつ安定した接合が行なえる。



【特許請求の範囲】
【請求項1】 電子部品（6）に加圧及び超音波振動を与えて、接合基板（3）に上記電子部品を接合するフリップチップ実装装置であつて、
上記電子部品及び上記接合基板の厚み方向に直交する直交方向に沿って振動する上記超音波振動を発生する振動子（113）と、
上記振動子を一端部（1131）に取り付けた超音波ホーン（114）と、
上記厚み方向に沿って延在して一端に上記電子部品を保持する保持部（1151）を有する保持部材（115）を上記保持部の近傍にて支持し、かつ上記超音波ホーンの他端部（1132）に固定され、かつ上記超音波振動によって上記厚み方向への振動が上記保持部材に生じることを防止する支持部材（131）と、
を備えたことを特徴とするフリップチップ実装装置。
【請求項2】 上記支持部材は、上記厚み方向において、上記超音波ホーンの上記他端部を間に位置させて、上記保持部近傍と、上記保持部近傍に対向した対向部分との2箇所（1311，1312）にて上記保持部材を支持する、請求項1記載のフリップチップ実装装置。
【請求項3】 上記支持部材は、上記保持部材が隙間（132）をあけて挿通される筒状体にてなり上記2箇所のみにて上記保持部材を支持する、請求項2記載のフリップチップ実装装置。
【請求項4】 上記支持部材又は上記保持部材に接触し、かつ加圧装置（111）から発した上記厚み方向へ作用する加圧力にて上記加圧力の作用方向と同軸上で上記電子部品及び上記接合基板を相対的に押圧する加圧部材（148）をさらに備えた、請求項1ないし3のいずれかに記載のフリップチップ実装装置。
【請求項5】 上記支持部材を固定する上記超音波ホーンの上記他端部は、上記振動子にて発する上記超音波振動における節部（1133）に相当する、請求項1ないし4のいずれかに記載のフリップチップ実装装置。
【請求項6】 それぞれが上記厚み方向に延在して上記支持部材を間に挟んで対向して配置され、かつ上記超音波ホーンを介して上記支持部材へ伝達した上記超音波振動にて上記支持部材に生じる撓み振動（154）における節部（155）にて上記支持部材を支持し、かつ加圧装置（111）から発した上記厚み方向へ作用する加圧力と同方向にて上記電子部品及び上記接合基板を相対的に押圧する一対の第1加圧部材（152－1）及び第2加圧部材（152－2）をさらに備えた、請求項3記載のフリップチップ実装装置。
【請求項7】 電子部品（6）に加圧及び超音波振動を与えて接合基板（3）に上記電子部品を接合するフリップチップ実装方法であつて、
上記超音波振動を上記電子部品に作用するとき、上記電子部品の厚み方向に上記電子部品が振動することを防止し、
上記加圧するとき、上記電子部品を保持して上記電子部品及び上記接合基板の厚み方向へ延在する保持部材（115）と同軸上にて、加圧力を作用させる、
ことを特徴とするフリップチップ実装方法。
【発明の詳細な説明】
【0001】
【発明の属する技術分野】本発明は、例えばＩＣチップに加圧及び超音波振動を与えて、接合基板に上記ＩＣチップを直接接合するフリップチップ実装装置、及び該フリップチップ実装装置にて実行されるフリップチップ実装方法に関するものである。
【0002】
【従来の技術】図9には、従来のフリップチップ実装装置30を示しており、搬送装置2にて搬入された接合基板3は、加熱ステージ4に供給され、該加熱ステージ4に保持、固定され、かつ加熱ステージ4に接続された加熱制御装置7にて制御されながら加熱される。次いでウェハーシート5から取り出されたＩＣチップ6は、接合加圧装置1に備わる接合部材15まで順次受け渡される。このＩＣチップ6は、接合部材15に吸着固定され、接合基板3の所定位置に認識動作により位置決めされる。次いでＩＣチップ6は、接合加圧装置1により、接合基板3に対して加圧及び超音波振動を与えられることにより、ＩＣチップ6のバンプ8と接合基板3の電極9とが金属接合される。
【0003】図10及び図11に示すように、上記接合加圧装置1は、ＩＣチップ6や接合基板3の厚み方向に上記接合部材15を移動させるとともにＩＣチップ6と接合基板3との接合のための加圧を行う、駆動部及び加圧装置としてのボイスコイルモータ11を有し、該ボイスコイルモータ11の駆動軸の先端部分にはブラケット12が設けられ、該ブラケット12には超音波ホーン14が取り付けられている。超音波ホーン14の一端部には上記接合部材15が取り付けられ、他端部には振動子13が取り付けられている。該振動子13には、超音波発振器17が接続され超音波振動を振動子13に発生させる。又、上記ボイスコイルモータ11は接合加圧制御装置16にて動作制御される。
【0004】上記超音波ホーン14には、その軸方向に沿って割り込みが設けられ、図11に示すように、接合部材15は、接合部材15の軸方向に直交方向から上記割り込みにて挟持されている。尚、上述のように接合部材15はＩＣチップ6を吸着するため、接合部材15には吸引用配管24が接続されているが、該吸引用配管24はブラケット12に支持されていない。又、超音波ホーン4は、上記振動子13が発する超音波振動の縦振動21の節22にあたる任意の位置をブラケット12で割り締め締結されており、上述のように該ブラケット22の上部に設置されているボイスコイルモータ11により

加圧される。

【0005】

【本発明が解決しようとする課題】しかしながら、上述のような従来の構造では、図１１に示すように、上記吸引用配管２４はブラケット１２に支持されておらず、かつ接合部材１５は超音波ホーン１４にて割り締めにて挟持されていることから、ＩＣチップ６が接合基板３に対して加圧及び超音波振動を与えられる接合工程において、接合部材１５は、締結部分を支点として、弾性体のごとく２点鎖線にて示すように振り子状に揺動する、外乱振動２５を発生してしまう。この接合部材１５の外乱振動２５が超音波ホーン１４に伝達される為、超音波ホーン１４の撓み振動２３をＩＣチップ６へ確実に伝達できない。上記撓み振動２３とは、振動子１３が発する超音波振動により超音波ホーン１４に生じる、図示するような１次モードの振動である。超音波ホーン１４に上記外乱振動２５が作用せず、撓み振動２３のみが超音波ホーン１４に生じたときには、ＩＣチップ６には、撓み振動２３により水平方向及び垂直方向に対して図示するように斜め方向に力が作用することになる。このような斜め方向への力、つまり上記撓み振動２３が生じることで、以下の作用が行われる。即ち、上記斜め方向への力における水平方向成分による水平方向への振動により、電極表面の酸化膜や汚れの除去、バンプと上記電極との間での原子拡散の促進がなされ、上記斜め方向への力における垂直方向成分による垂直方向への振動により、加圧力の増大が図られバンプを変形させて電極との接触面積を拡大し接合強度の確保が図られる。しかしながら従来構造では、上述したように外乱振動２５が超音波ホーン１４に伝達される為、上記撓み振動２３による上記作用が困難になり、ＩＣチップ６と接合基板３との充分な接合強度が得られなくなり、接合オープン不良を誘発する原因となっている。

【0006】更に、上述のように、接合部材１５を挟持している超音波ホーン１４は、ブラケット１２に挟持されていることから、接合工程において、接合部材１５に対してはブラケット１２を介して節２２を支点としたモーメント方向に加圧がなされる為、発生する応力が、超音波ホーン１４が接合部材１５を挟持する部分、ブラケット１２が超音波ホーン１４を挟持する部分、及びブラケット１２における剛性よりも大きくなってしまう。よって、極端な図示であるが図１２に示すようにブラケット１２や接合部材１５の挟持部分等における変形により、接合部材１５と加熱ステージ４との、即ちＩＣチップ６と接合基板３との平行度の維持が困難となる。したがって、上記水平方向振動のみならず垂直方向の外乱振動がＩＣチップ６に合成されてしまう為、ＩＣチップ６と接合基板３との充分な接合強度が得られなくなり、接合オープン不良を誘発する原因となっている。

【0007】さらに又、近年、電子機器の軽薄短小化に伴い電子デバイスの小型化が益々求められており、実装技術はワイヤリング方式からフリップチップ方式へと転換期を迎え、大型かつ多ピンＩＣチップでも接合可能となることが大きな課題となっている。このような条件下では、接合加圧力及び超音波パワーの増大が必要となる為、従来の構成のままでは、上記接合オープン不良が激増することは明白である。

【0008】本発明はこのような問題点を解決するためになされたもので、電子部品と基板との十分な接合強度が得られ、安定した接合を行える、フリップチップ実装装置、及び方法を提供することを目的とする。

【0009】

【課題を解決するための手段】本発明の第１態様のフリップチップ実装装置は、電子部品に加圧及び超音波振動を与えて、接合基板に上記電子部品を接合するフリップチップ実装装置であつて、上記電子部品及び上記接合基板の厚み方向に直交する直交方向に沿って振動する上記超音波振動を発生する振動子と、上記振動子を一端部に取り付けた超音波ホーンと、上記厚み方向に沿って延在して一端に上記電子部品を保持する保持部を有する保持部材を上記保持部の近傍にて支持し、かつ上記超音波ホーンの他端部に固定され、かつ上記超音波振動によって上記厚み方向への振動が上記保持部材に生じることを防止する支持部材と、を備えたことを特徴とする。

【0010】又、本発明の第２態様のフリップチップ実装方法は、電子部品に加圧及び超音波振動を与えて接合基板に上記電子部品を接合するフリップチップ実装方法であつて、上記超音波振動を上記電子部品に作用するとき、上記電子部品の厚み方向に上記電子部品が振動することを防止し、上記加圧するとき、上記電子部品を保持して上記電子部品及び上記接合基板の厚み方向へ延在する保持部材と同軸上にて、加圧力を作用させる、ことを特徴とする。

【0011】

【発明の実施の形態】本発明の実施形態におけるフリップチップ実装装置、及び該フリップチップ実装装置にて実行されるフリップチップ実装方法について、図を参照しながら以下に説明する。尚、各図において、同じ構成部分については同じ符号を付している。又、電子部品に相当する一例として本実施形態では上述したＩＣチップ６を例に採る。図６に示すように、本実施形態のフリップチップ実装装置１０１は、図９を参照して説明した従来のフリップチップ実装装置３０と類似の構成を有する。即ち、従来のフリップチップ実装装置３０と本実施形態のフリップチップ実装装置１０１とで大きく相違する所は、接合加圧装置であり、これ以外の各構成部分の内、従来のフリップチップ実装装置３０と同一の構成部分については同符号を付してここでの説明を省略する。又、本実施形態にて使用する、超音波振動とは、ＩＣチップ６と接合基板３との接合が可能な程度、具体的には

周波数６４ｋＨｚ、振幅０．５～２μｍ程度の振動をいう。又、本実施形態にて用いるＩＣチップ６は、一例として大きさが□２ｍｍのシリコンチップで、バンプ数が２０個であるが、例えば大きさが□１０ｍｍ程度で、１００バンプ程度のチップまで本実施形態は適用可能である。

【００１２】本実施形態のフリップチップ実装装置１０１に備わる接合加圧装置１１０は、ボイスコイルモータ１１１、接合加圧制御装置１１６、超音波発振器１１７、等を備えるが、図１０に示された従来の接合加圧装置１にて、図示においてブラケット１２よりも上方に示された構成部分、つまりボイスコイルモータ１１、当該接合加圧装置１用の移動装置部分は、上記接合加圧装置１１０においても同一構成を採っている。即ち、加圧装置の機能を果たす一例としてのボイスコイルモータ１１１は上記ボイスコイルモータ１１に相当し、上記接合加圧制御装置１１６は上記接合加圧制御装置１６に相当する。よって、上記接合加圧装置１１０にて特徴的な部分は、例えば図１に示すように、ボイスコイルモータ１１１よりも下方の部分、つまりブラケット１１２等を含む部分である。よって以下には、上記特徴的な部分について説明する。

【００１３】上記接合加圧装置１１０においても、ＩＣチップ６及び接合基板３の厚み方向に直交する直交方向に沿って振動する超音波振動を発生する振動子１１３と、該振動子１１３を一端部１１３１に取り付けた超音波ホーン１１４と、電子部品の一例としてのＩＣチップ６の厚み方向に沿って延在し、一端にＩＣチップ６を保持する保持部１１５１を備えた保持部材１１５とを有するとともに、接合加圧装置１１０ではさらに図５に示すような支持部材１３１を設けている。支持部材１３１は、図１１を参照して説明した外乱振動２５が上記保持部材１１５に発生しないようにする部材である。本実施形態では、支持部材１３１は、保持部材１１５の軸方向に沿って隙間１３２を有しながら保持部材１１５が挿通される筒状体にてなり、保持部材１１５が貫通する挿通部分の一端部１３１１及び他端部１３１２の２箇所にて保持部材１１５を支持する。このような支持部材１３１は、超音波ホーン１１４の他端部１１３２に固定される。又、本実施形態のように超音波ホーン１１４と一体的に成形することもできる。

【００１４】又、本実施形態では、大きさ等が異なる種々のＩＣチップ６に対応可能とするため、上述したような２箇所にて支持部材１３１は保持部材１１５を支持する構造とし支持部材１３１に対して保持部材１１５を着脱可能な構造としている。しかしながら、もし保持部材１１５を変更することがないならば、図７に示すように、超音波ホーン１１４の他端部１１３２の近傍に上記保持部１１５１を配置しかつ支持部材１３１５は保持部材１１５を一箇所にて、つまり保持部１１５１にて固定するように構成することもでき、又、図８に示すように支持部材１３１５の両端箇所にて保持部材１１５を例えば溶接にて支持部材１３１５に固定してもよい。

【００１５】上記隙間１３２は以下に説明する程度の隙間である。即ち、支持部材１３１には、振動子１１３より発した上記超音波振動によって図１に２点鎖線にて示すように、上述の撓み振動２３と同様の１次モードの撓み振動１５４が生じる。一方、支持部材１３１にて支持されている保持部材１１５にも、振動子１１３より発した上記超音波振動により振動が生じるが、保持部材１１５は支持部材１３１に比べて細いので、上記撓み振動１５４のように１次モードにはならず、複数次モードの振動となってしまう。よって、保持部材１１５における上記複数次モードの振動が支持部材１３１に伝わると、支持部材１３１に外乱振動を生じさせてしまう。そこで本実施形態では、振動している保持部材１１５の外面と、筒状体にてなる支持部材１３１の内面とが接触するのを防止する程度の隙間１３２を設けた。このように上記接触を防止することで、保持部材１１５による上記外乱振動を超音波ホーン１１４に伝達させず、超音波ホーン１１４の撓み振動１５４を保持部材１１５を介してＩＣチップ６へ確実に伝達することができる。超音波ホーン１１４における上記撓み振動の振幅は約２μｍであるので、上記隙間１３２は、本実施形態では５μｍ程度とした。しかしながら、隙間１３２の値は、上記の値に限定されるものではなく、上述のように、支持部材１３１の内面と保持部材１１５の外面とが接触するのを防止可能な寸法であればよい。

【００１６】上述したような隙間１３２を生じさせるため、本実施形態では、保持部材１１５の上記保持部１１５１を、図５に示すように、段付き形状にして支持部材１３１の一端部１３１１に嵌合させて固定し、かつ支持部材１３１の他端部１３１２では、例えばカラー１３３を介在させた状態にて保持部材１１５に形成したネジ部１３５にナット１３４を螺合させ、保持部材１１５を支持部材１３１に固定する。尚、上述したように本実施形態では、保持部材１１５は吸着動作にてＩＣチップ６を保持することから、図５に示すように保持部材１１５には吸引用通路１１５３が形成されており、ネジ部１１５２を超えて吸引用通路１１５３は延在する。又、支持部材１３１に種々の波形にてなる外乱振動を生じさせないために、図示するように、支持部材１３１の延在方向におけるほぼ中間部分にて、支持部材１３１は、超音波ホーン１１４に取り付けられる、又は本実施形態のように超音波ホーン１１４と一体的に成形されるのが好ましい。

【００１７】振動子１１３が取り付けられた超音波ホーン１１４を取り付けた上述の構造を有する支持部材１３１は、例えば図１に示すように、第１ブラケット１４１及び第２ブラケット１４２を有する取付構造にてボイス

コイルモータ１１１の駆動軸端部１１１１に取り付けられる。即ち、駆動軸端部１１１１には、Ｌ字状の第１ブラケット１１２が取り付けられる。一方、超音波ホーン１１４には、図２に示すように、当該超音波ホーン１１４の延在方向に直交する方向に沿って第２ブラケット１４２を取り付けるための一対の取付用ラグ１４３が所定位置に突設されている。該所定位置とは、超音波ホーン１１４の一端部１１３１に取り付けられた振動子１１３から発する縦振動１１３２が超音波ホーン１１４に伝達されたときの振動における節１１３３の位置にて、取付用ラグ１４３が第２ブラケット１４２に接触するような位置である。このように節１１３３にて取付用ラグ１４３と第２ブラケット１４２とが接触し下記のように締結されることで、超音波ホーン１１４は縦振動を抑制されるので、つまり共振することができなくなるので、締め付けトルクによる超音波ホーン１１４の周波数特性の変化を抑制することができる。上記第２ブラケット１４２は、超音波ホーン１１４に直接接触するのを避けるため、超音波ホーン１１４用の切り欠き１４４を有する凹形状であり、固定用ボルト１４５にて上記取付用ラグ１４３と締結される。該締結により、保持部材１１５を有する支持部材１３１、超音波ホーン１１４、及び振動子１１３は、第２ブラケット１４２に固定される。

【００１８】このような第１ブラケット１４１及び第２ブラケット１４２は、互いにリニアガイド１４６を介して係合するとともに、該リニアガイド１４６にて移動方向がガイドされながら第２ブラケット１４２は、第１ブラケット１４１に対して上記厚み方向に沿って移動可能である。又、リニアガイド１４６にて第１ブラケット１４１及び第２ブラケット１４２が係合した状態にて、ボイスコイルモータ１１１の上記厚み方向に沿って延在する駆動軸と同軸上に支持部材１３１の中心軸、つまり保持部材１１５の中心軸が位置する。又、第１ブラケット１４１と第２ブラケット１４２との間には、上記厚み方向に沿って第１ブラケット１４１側に第２ブラケット１４２を付勢するスプリング１４７が設けられている。さらに又、第１ブラケット１４１には、ボイスコイルモータ１１１の駆動軸と同軸上にて加圧部材１４８を設けている。上述のように、上記駆動軸と同軸上には保持部材１１５が延在し、かつ支持部材１３１を取り付けた第２ブラケット１４２は上記スプリング１４７にて第１ブラケット１４１側に付勢されていることから、加圧部材１４８は、図示するように、支持部材１３１に固定された保持部材１１５の上記ネジ部１１５２、又は上記ナット１３４に常に接触する。よって、ボイスコイルモータ１１１の上記駆動軸が上記厚み方向の矢印１４９方向に移動することで、上記駆動軸端部１１１１及び第１ブラケット１４１を介して加圧部材１４８は、矢印１４９方向に保持部材１１５を加圧する。尚、吸引用通路１１５３を有する保持部材１１５は、加圧部材１４８、第１ブラケット１４１、及び駆動軸端部１１１１を貫通している。

【００１９】次に、図１に示す上述した取付構造を有する本実施形態のフリップチップ実装装置の動作について説明するが、ＩＣチップ６の接合基板３への実装動作以外の動作は、従来における動作に変わりないので、ここでの説明は省略する。よって以下には、ＩＣチップ６を接合基板３に実装するときの動作について説明する。超音波発振器１１７により振動子１１３が発振し、保持部材１１５に保持されているＩＣチップ６は超音波振動する。このとき、本実施形態では上述のように、保持部材１１５は隙間１３２を設けた状態にて支持部材１３１に支持され、かつ該支持部材１３１に超音波ホーン１１４が固定されていることから、支持部材１３１は外乱振動の発生を防止することができる。よって、超音波ホーン１１４、つまり支持部材１３１における撓み振動１５４をＩＣチップ６へ確実に伝達することができるので、接合品質を向上させることができる。さらに、このような状態にて、接合加圧制御装置１６の制御により、ボイスコイルモータ１１１が動作し加圧部材１４８にて矢印１４９方向へ加圧が行われ、該加圧により該加圧方向と同軸上にて保持部材１１５がＩＣチップ６を接合基板３に押圧され、該押圧力が制御される。

【００２０】したがって、ＩＣチップ６と接合基板３との十分な接合強度が得られ、かつ上記押圧を行っていない無負荷状態における保持部材１１５の保持部１１５１と加熱ステージ４との間に要求される平行度の値としての２μｍ以下の精度を、加圧時においても維持することができ、安定した接合が可能となる。尚、上記２μｍ以下の精度は、ＩＣチップ６のサイズが□２ｍｍ、加圧力１４．６Ｎの場合であり、又、従来のフリップチップ実装装置では、同条件では１０μｍ程度の精度しか得られなかった。

【００２１】又、保持部材１１５を設けた支持部材１３１のボイスコイルモータ１１１への取り付け構造は、図１及び図２に示す構造に限定されるものではなく、例えば図３及び図４に示す接合加圧装置１５１の構造を採ることもできる。即ち、図４に示すように、それぞれが上記厚み方向に延在して支持部材１３１を間に挟んで対向して配置される一対の第１加圧部材１５２－１及び第２加圧部材１５２－２を有し、全体形状がコ字状の支持加圧部材１５３をボイスコイルモータ１１１の上記駆動軸端部１１１１に取り付ける。上記第１加圧部材１５２－１及び第２加圧部材１５２－２は、上記超音波ホーン１１４を介して上記支持部材１３１へ伝達した上記超音波振動にて支持部材１３１に生じる撓み振動１５４における節部１５５に対応した位置に設けた支持ピン１５６にて支持部材１３１を支持する。このように節部１５５にて支持部材１３１を支持することで、撓み振動１５４の節部１５５を通して加圧が可能になるので、より安定し

た撓み振動１５４を得ることができる。よって、該安定した撓み振動１５４がＩＣチップ６に作用することになるので、ＩＣチップ６の接合基板３への接合をより強固にすることができる。

【００２２】さらに、ボイスコイルモータ１１１の駆動軸が上記厚み方向へ移動することで、第１加圧部材１５２－１及び第２加圧部材１５２－２は、上記支持ピン１５６を介して支持部材１３１を上記厚み方向、つまり支持部材１３１に備わる保持部材１１５の軸方向へ移動させる。よって、保持部材１１５の保持部１１５１に保持されているＩＣチップ６を接合基板３へ上記厚み方向に沿って押圧することができる。このように接合加圧装置１５１においても、上述の接合加圧装置１１０の場合と同様に、ＩＣチップ６と接合基板３との十分な接合強度が得られ、かつ上記押圧を行っていない無負荷状態における保持部材１１５の保持部１１５１と加熱ステージ４との間に要求される平行度の値としての２μm以下の精度を、加圧時においても維持することができ、安定した接合が可能である。

【００２３】尚、上述した実施形態では、いずれもボイスコイルモータ１１１にてＩＣチップ６を接合基板３へ押圧したが、これとは逆に、接合基板３を載置した加熱ステージ４に移動装置を設けて接合基板３をＩＣチップ６へ押圧するように構成してもよい。要するに、ＩＣチップ６と接合基板３とを相対的に移動させて両者の押圧を図れる構成を採れば良い。

【００２４】又、上述の実施形態では、吸着動作にてＩＣチップ６を保持したが、これに限定されず、例えば機械的ＩＣチップ６を保持する構成をとることもできる。

【００２５】

【発明の効果】以上詳述したように本発明の第１態様のフリップチップ実装装置、及び第２態様のフリップチップ実装方法によれば、支持部材を備え、該支持部材について、電子部品を保持する保持部を有する保持部材を上記保持部の近傍にて支持し、かつ上記超音波ホーンの他端部に固定するようにした。よって、保持部材にて保持される電子部品に対する厚み方向への外乱振動が抑止され、超音波ホーンの撓み振動を上記電子部品へ確実に伝達することができるので、電子部品と接合基板との充分な接合強度が得られ、かつ接合品質を向上させることができる。

【図面の簡単な説明】

【図１】　本発明の実施形態のフリップチップ実装装置における接合加圧装置の支持部材部分を示す側面図である。

【図２】　図１に示す支持部材部分の正面図である。

【図３】　図１に示す支持部材部分の変形例を示す側面図である。

【図４】　図３に示す支持部材部分の正面図である。

【図５】　図１～図４に示す支持部材の断面図である。

【図６】　図１に示す支持部材を有する本発明の実施形態のフリップチップ実装装置の斜視図である。

【図７】　図１に示す支持部材部分のさらに別の変形例を示す側面図である。

【図８】　図７に示す支持部材部分の変形例を示す側面図である。

【図９】　従来のフリップチップ実装装置の斜視図である。

【図１０】　図９に示す従来のフリップチップ実装装置に備わる接合加圧装置部分の斜視図である。

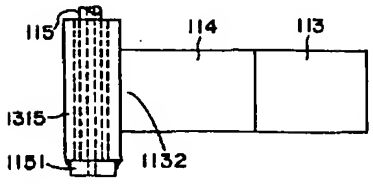
【図１１】　図１０に示す従来の接合加圧装置における保持部材部分を示す側面図である。

【図１２】　図１１に示す保持部材部分において、ＩＣチップと接合基板との平行度が劣化する場合を説明するための図である。

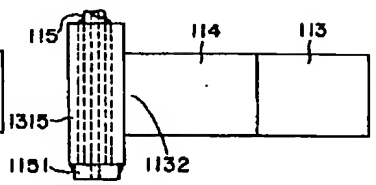
【符号の説明】

３…接合基板、６…ＩＣチップ、１０１…フリップチップ実装装置、１１１…ボイスコイルモータ、１１３…振動子、１１４…超音波ホーン、１１５…保持部材、１３１…支持部材、１４８…加圧部材、１５２－１…第１加圧部材、１５２－２…第２加圧部材、１５４…撓み振動、１５５…節部、１１３２…他端部、１１３３…節部、１１５１…保持部、１３１１…一端部、１３１２…他端部。

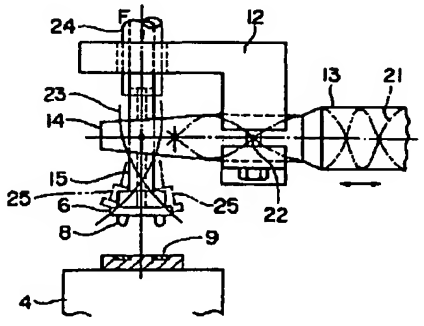
【図7】



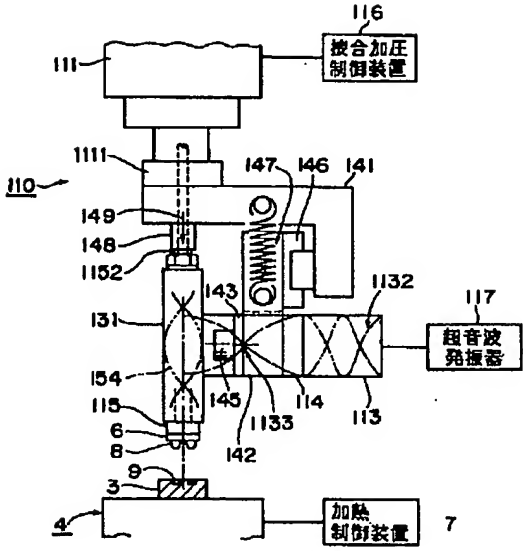
【図8】



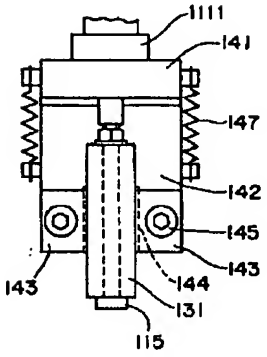
【図11】



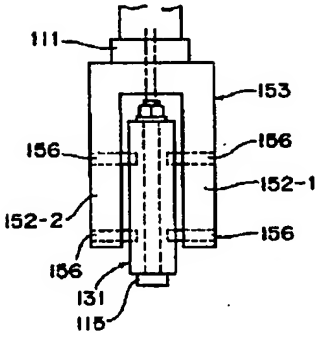
【図1】



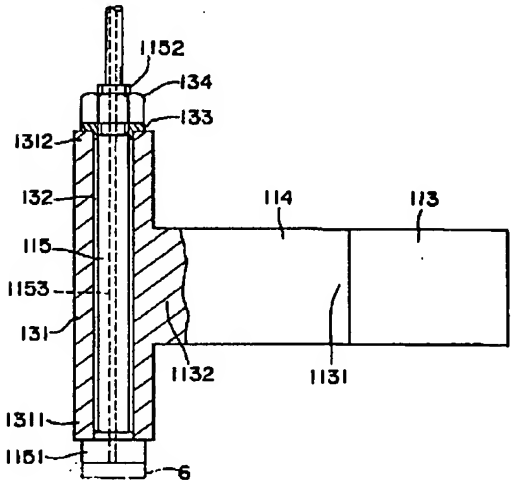
【図2】



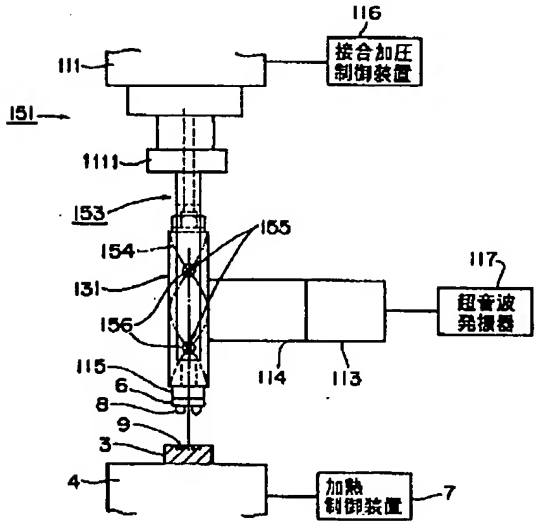
【図4】



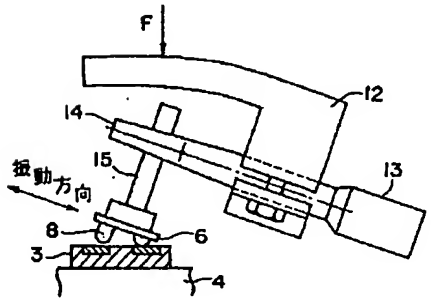
【図5】



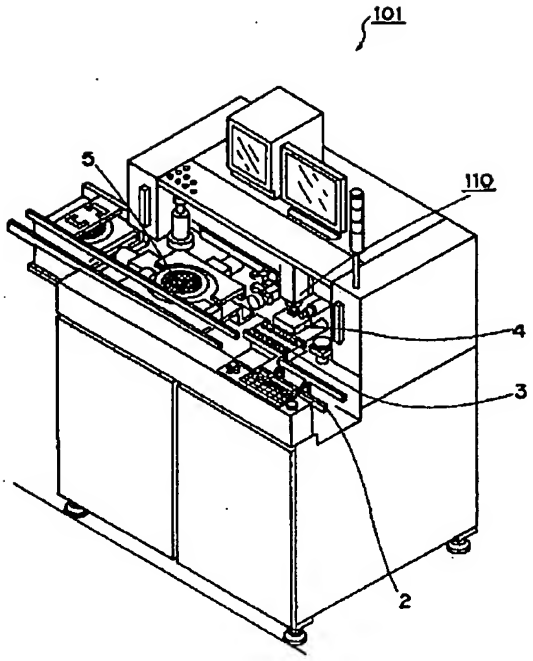
【図3】



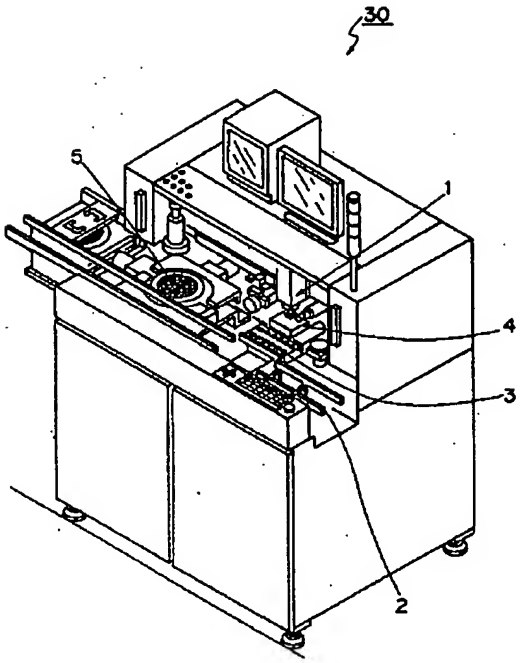
【図12】



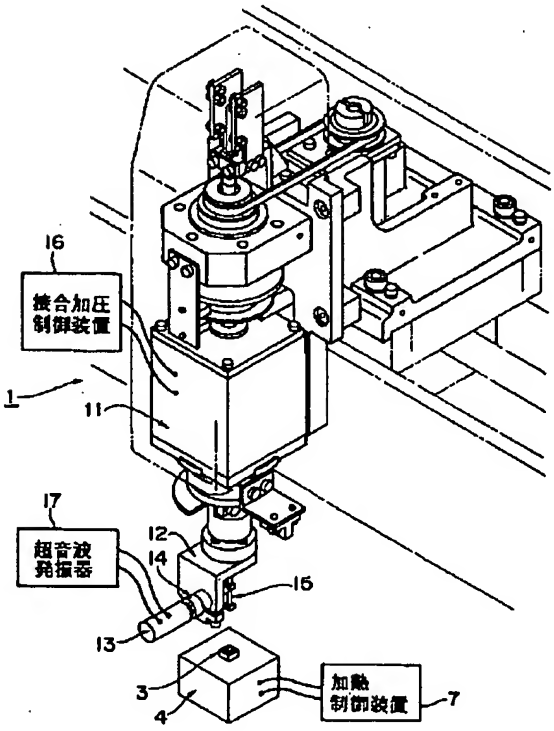
【図6】


101
5
110
4
3
2

【図9】


30
5
1
4
3
2

【図10】


16
接合加圧
制御装置
1
11
17
超音波
発振器
12
14
15
13
3
4
加熱
制御装置
7

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